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Water Vapor Profiles from AIRS
Comparison of AIRS *SST* and Water Vapor with AMSR-E and Radiosondes

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AMSR-E Science Team Meeting

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Overview of Talk

- **Comparison between AIRS and AMSR-E**
  - ***Total Water Vapor***
  - ***SST***
- **Comparison between AIRS and dedicated radiosondes**
  - ***Determine height-resolved uncertainties in T and q.***

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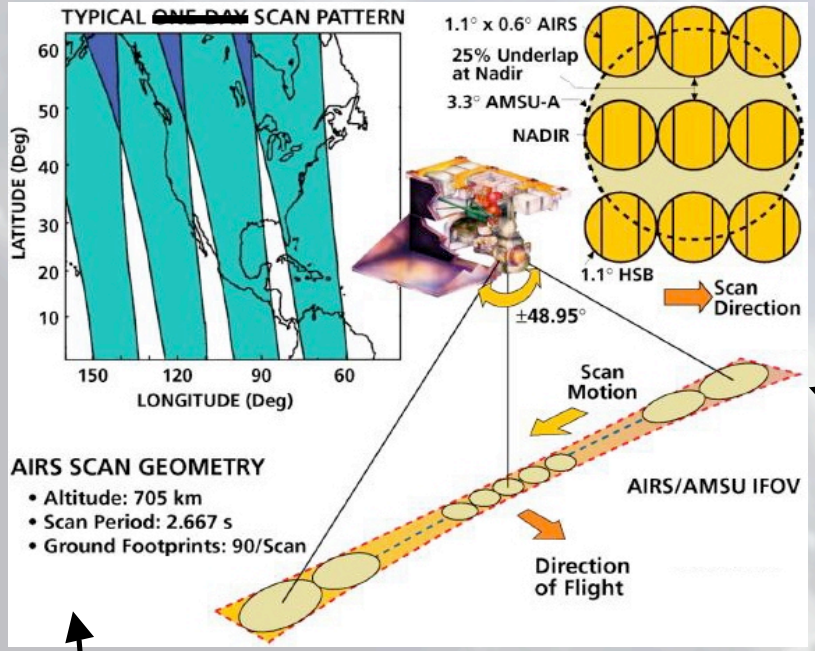
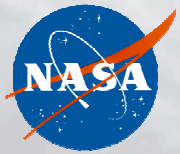
The AIRS Viewing geometry



1. **AMSU footprint, 45 km across at nadir, contains 9 AIRS spectra**
   - ***THIS IS THE RETRIEVAL GRANULARITY.***
2. **Viewing swath 30 AMSU footprints or ~1650 km wide.**
3. **The result: 324,000 retrievals per day**



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AIRS Products

Radiance Products (Level 1B)	RMS Uncertainty	Horizontal Resolution
AIRS IR Radiance	3%	15 x 15 km
AIRS VIS/NIR Radiance	20%	2.3 x 2.3 km
AMSU Radiance	0.25-1.2 K	45 x 45 km
HSB† Radiance	1.0-1.2 K	15 x 15 km
Standard Core Products (Level 2)		
Cloud Cleared IR Radiance	1.0K	45 x 45 km
Sea Surface Temperature	0.5K	45 x 45 km
Land Surface Temperature	1.0K	45 x 45 km
Temperature Profile (per 1 km)	1K	45 x 45 km
Humidity Profile (per 2 km)	15%	45 x 45 km
Total Precipitable Water	5%	45 x 45 km
Fractional Cloud Cover	5%	45 x 45 km
Cloud Top Height	0.5 km	45 x 45 km
Cloud Top Temperature	1.0 K	45 x 45 km

† HSB has not been operational since February 2003

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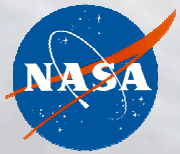
AIRS - AMSR-E Comparisons
Approach and Methodology

- **Examine total water vapor (and SST)**
- **6 September 2002**
- **Oceans only, ±50° latitude**
- **Two goals:**
  1. ***Look for global biases***
  2. ***Look for biases as a function of AIRS retrieved cloud amount***



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Approach and Methodology (continued)

- **Footprint-by-footprint comparisons at AIRS retrieval horizontal resolution**
- **Match nearest AMSR neighbor to AIRS retrieval**
  - ***Data from http://www.ssmi.com/***
- **Generate separate statistics on "retrieval_type"**
  - ***Full IR+MW retrievals: [0-10]***
  - ***MW-only retrievals: [20-50]***
- **Generate separate statistics for ascending and descending passes.**

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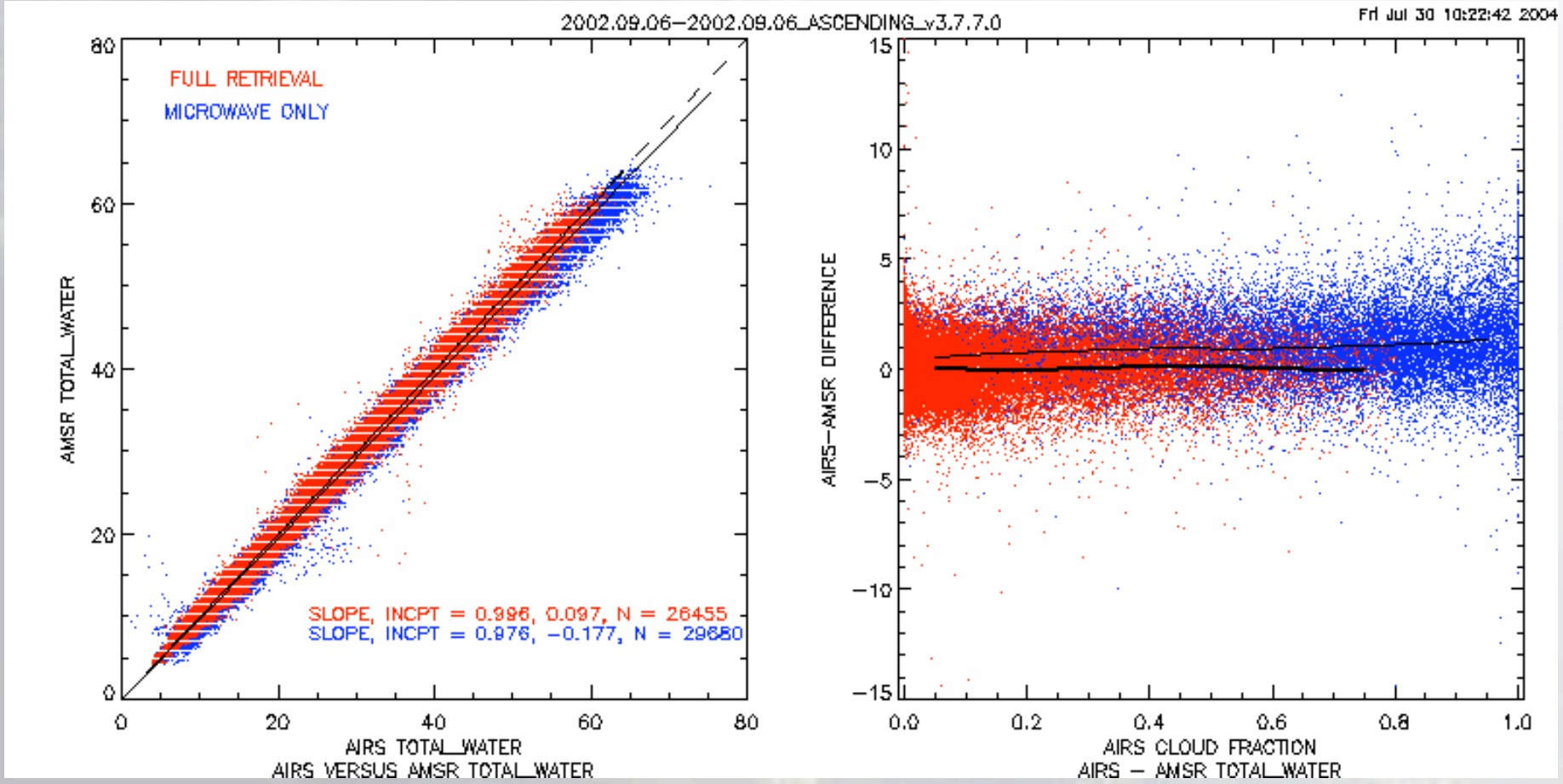
AIRS vs. AMSR-E
Total Water, Ascending, v3.6.0



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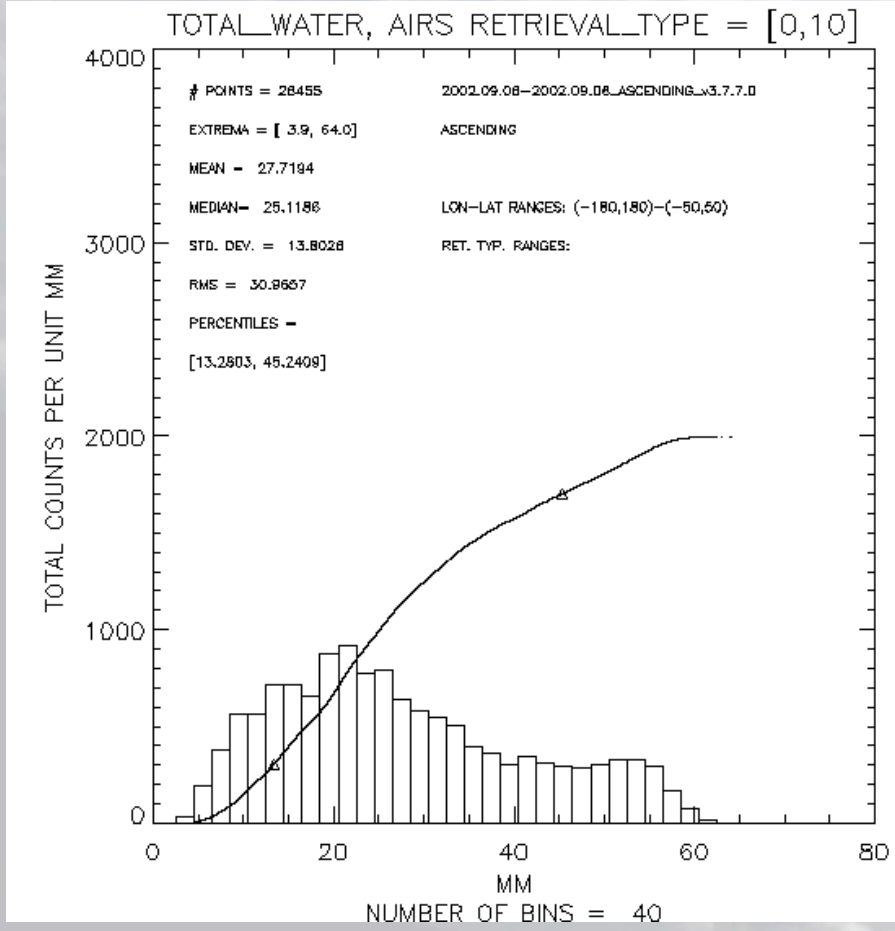
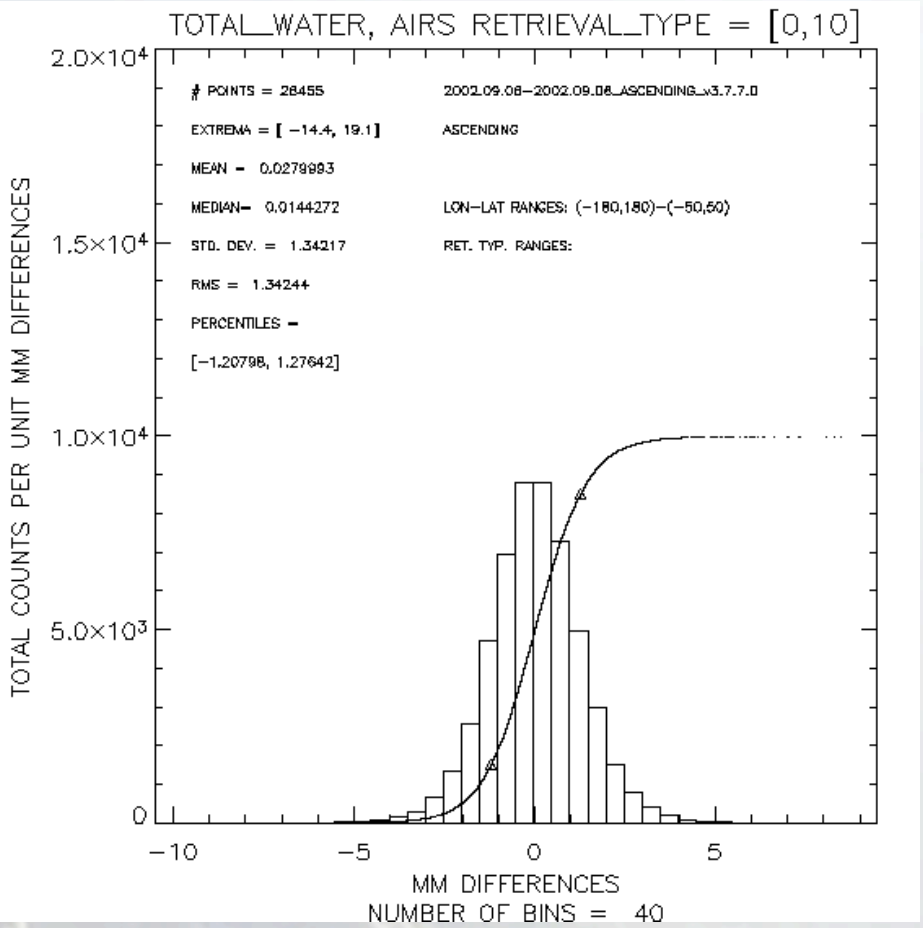
Distributions of AIRS and Differences

Total Water, Ascending, Full retrievals





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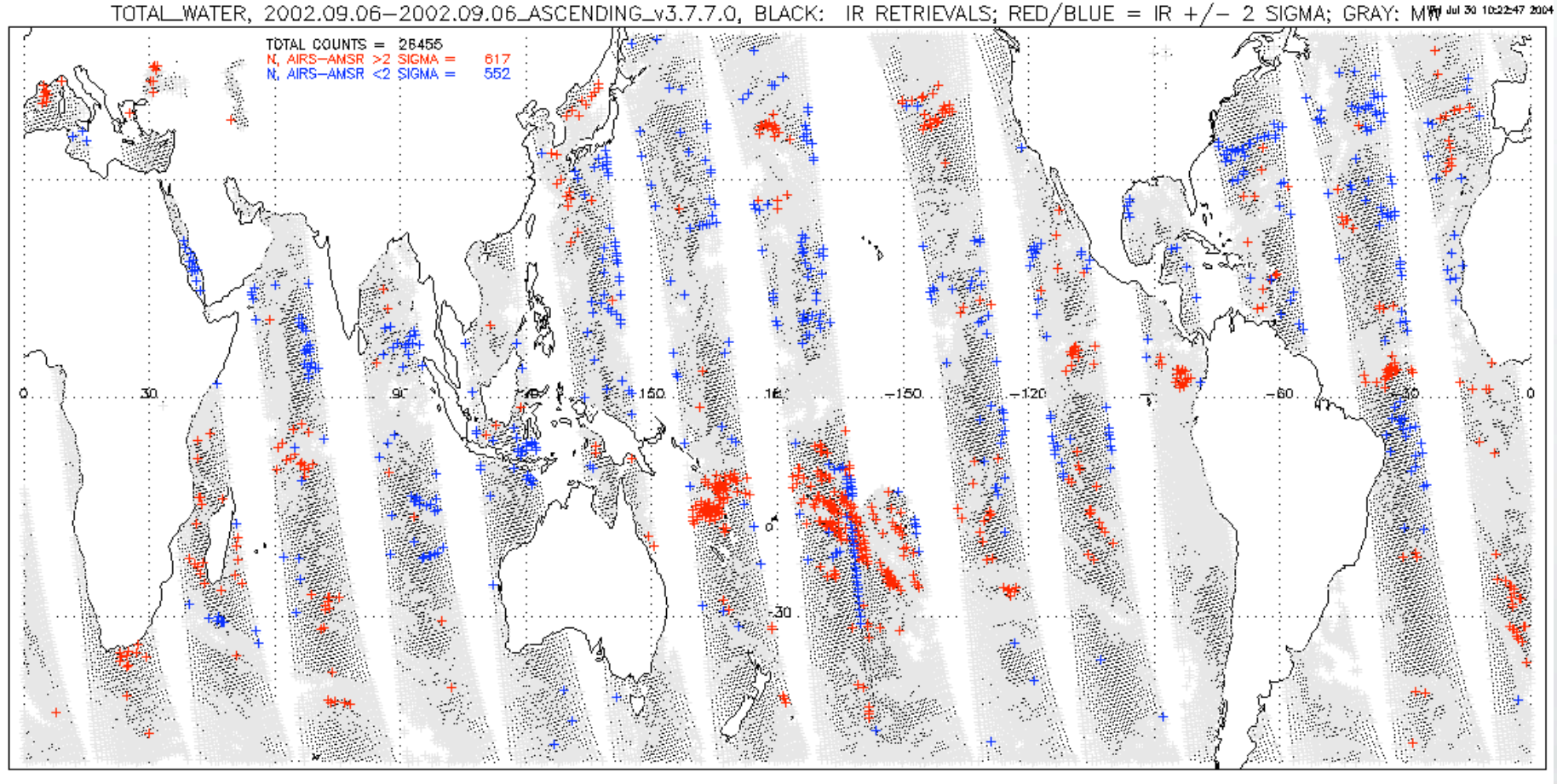
Where Differences Occur

Total Water, Ascending, Full retrievals



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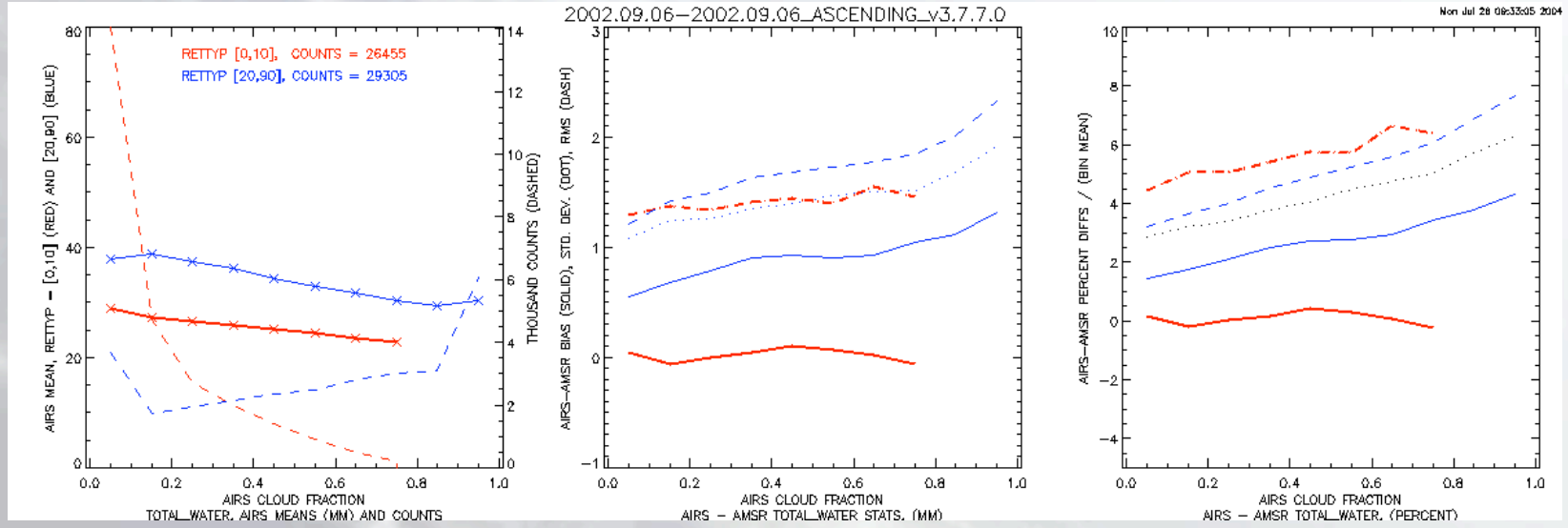
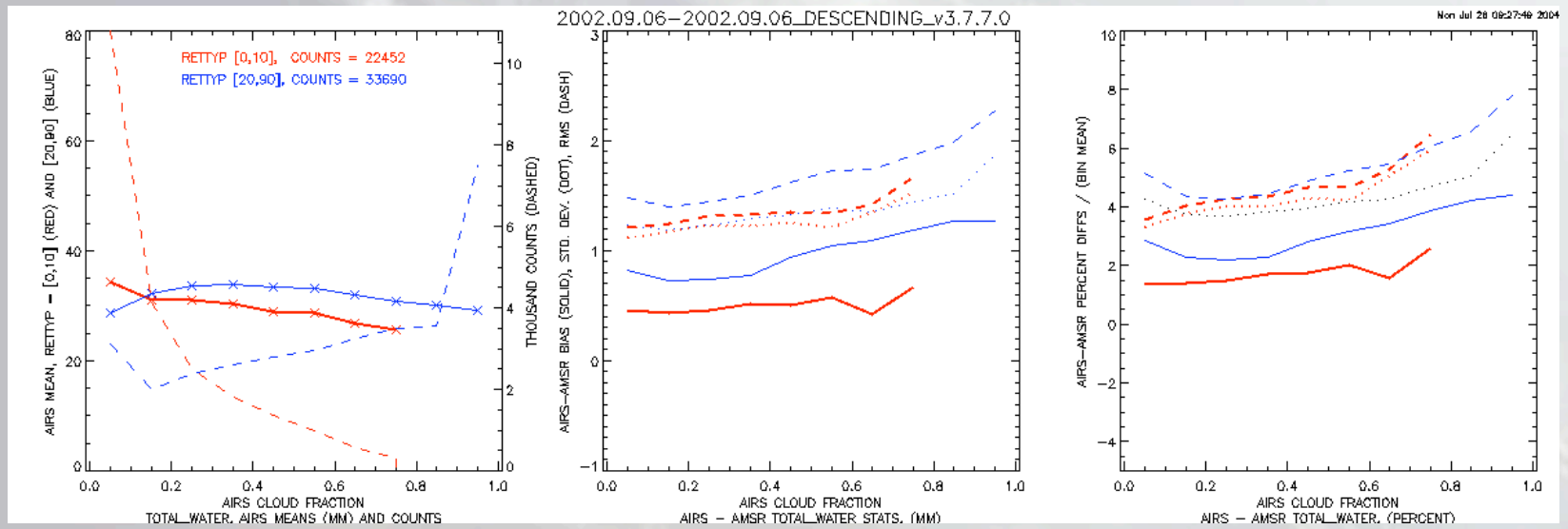
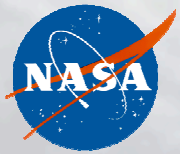
Differences as a function of retrieved cloud amount

Red: full retrievals; Blue: MW only







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Conclusions

Global Differences, Total Water

- **AMSR-E and AIRS total water are highly correlated for Full and MW-only AIRS retrievals.**
- **AIRS is wetter than AMSR-E by ~ 0.4 mm precipitable water at night; global mean AIRS = 32 mm.**
  - ***~1% bias at night***
  - ***no bias during daytime***
- **The histogram of differences is highly symmetric and apparently Gaussian**
- **No bias with increasing cloud amount for full AIRS retrievals**
- **AIRS shows very slight negative bias for MW-only retrievals, approaching zero as cloud amount increases**

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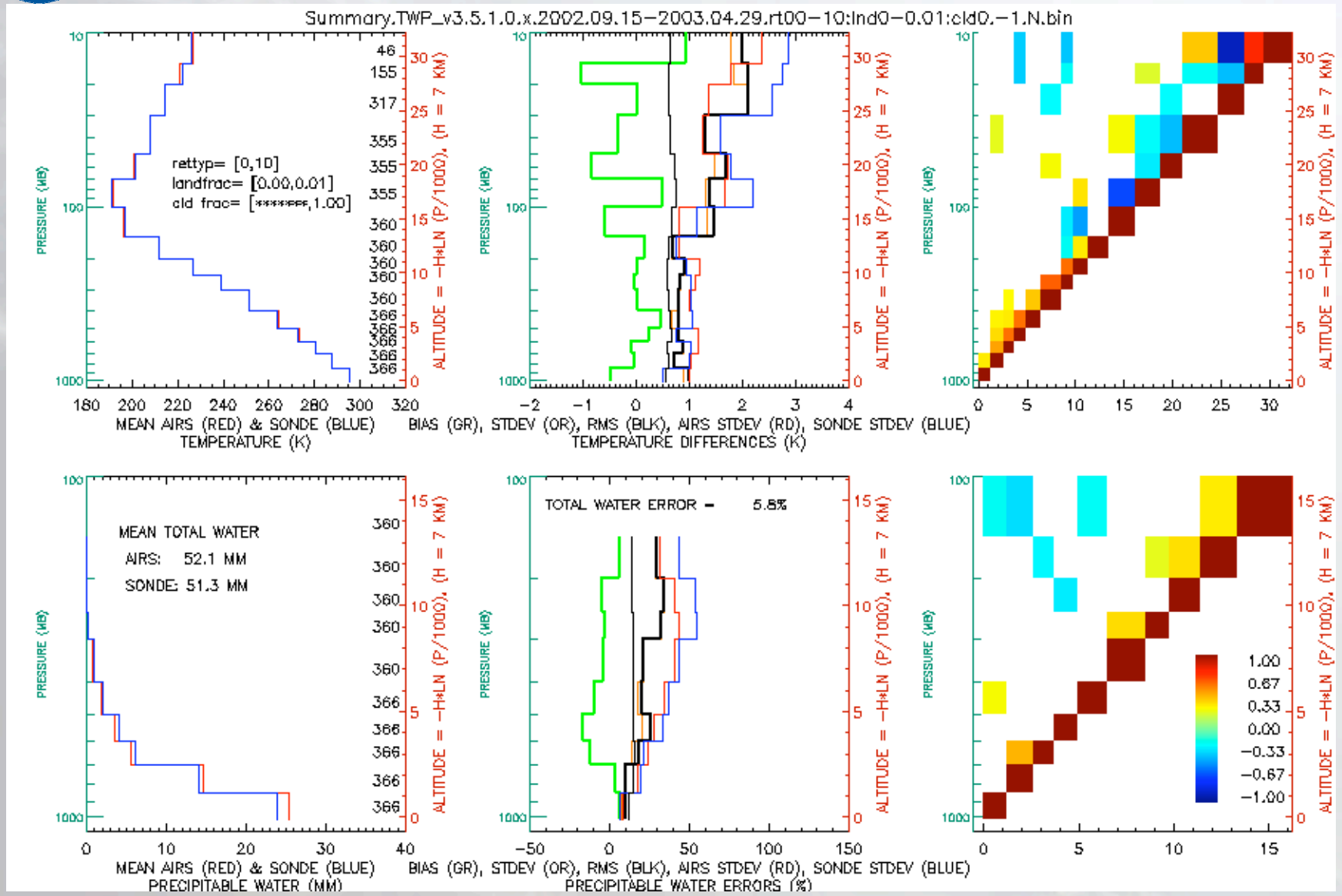
Differences with Radiosondes
Full Retrievals



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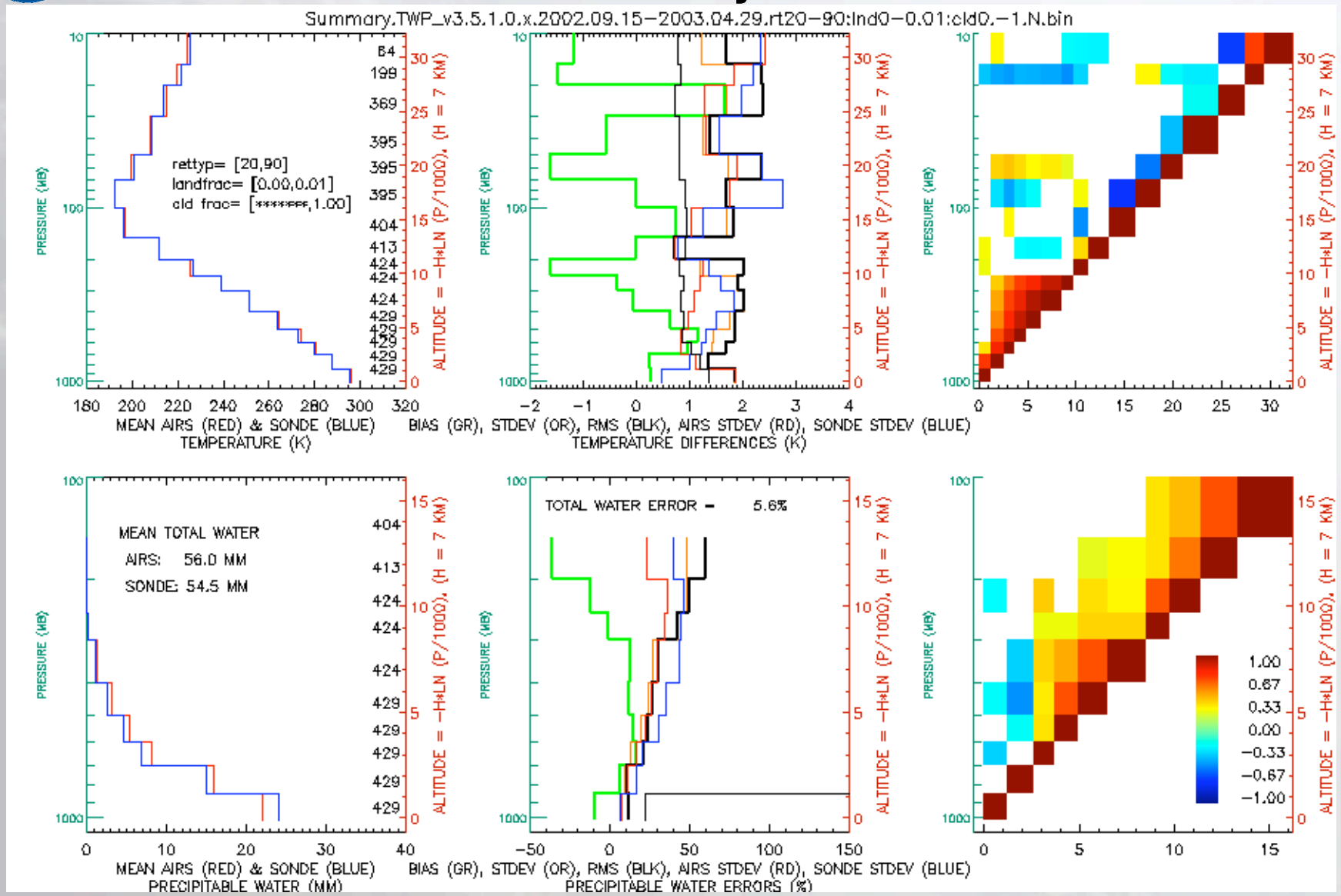
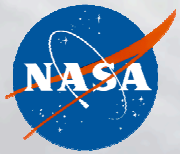
Differences with Radiosondes
MW-Only Retrievals





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Differences with Radiosondes

Summary of Current Understanding

- **AIRS meets 1 K / km RMS requirement for temperature profiles**
- **AIRS meeting 20% / 2km RMS requirement for absolute humidity profiles**
  - ***within the measurement uncertainties of the sondes***

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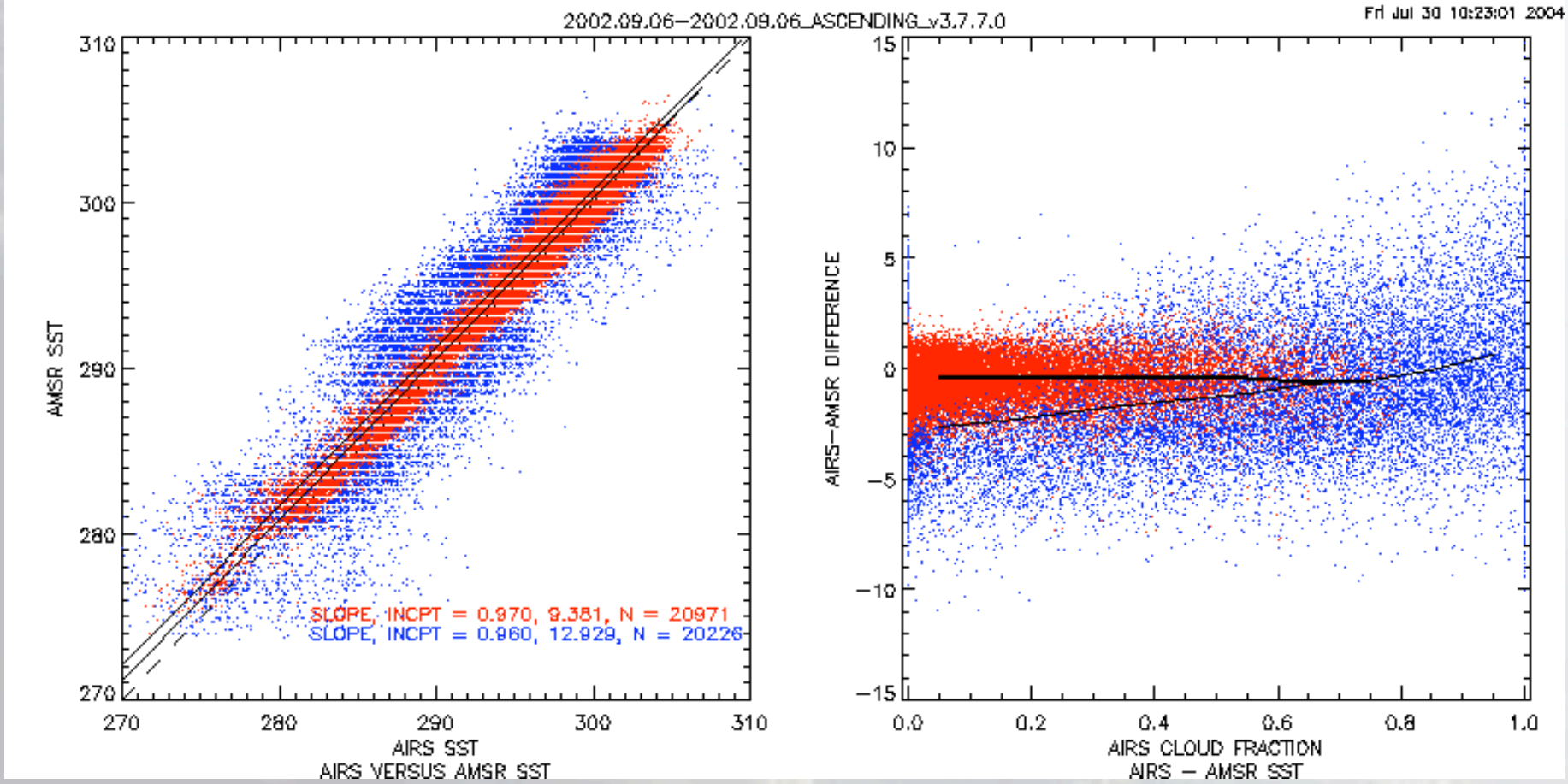
AIRS - AMSR-E SST Comparison



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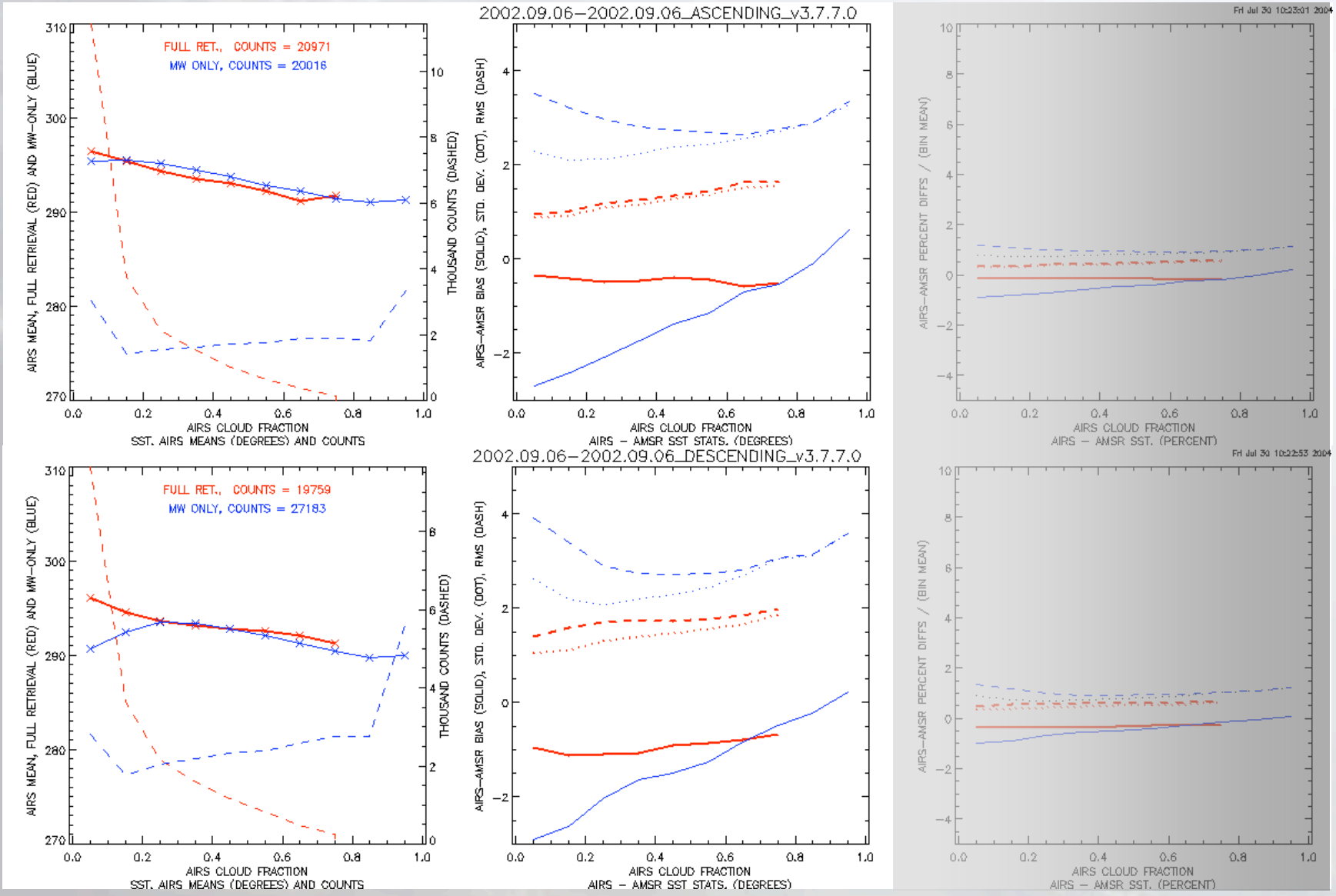
SST Difference Stats



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Conclusions: AIRS and AMSR SST Comparison

- **Full AIRS retrieval biases do not change with cloud amount**
  - ***Cold bias of <1 K.***
- **Microwave-only biases slightly negative, approaching zero with cloud amount.**

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